1/3/17 A Block Mr. Guerin

Things to Know, Understand and Do
For Chapters 7 & 8: Shapes of Molecules and Intermolecular Forces

By the end of Chapter 6, you should

Know how to...
Define the terms chemical bond, covalent bond, ionic bond, polarity, dipole, hydrogen bonds, , intermolecular force.
Predict if compound is ionic or covalent only using periodic trends of electronegativities as outlined on the periodic table.
Use electronegativity trends (outlined on periodic table) to determine if bond is polar-covalent, non-polar covalent or ionic. (even or uneven electron sharing)
Draw Lewis Structures for small molecules and ions.
Use VSEPR (valence shell electron-pair repulsion theory) to explain the molecular geometry and bond angles of molecules or ions.
Predict bond angles for any angle on a given molecule or ion.
Use molecular geometry and bond dipoles to predict molecular polarity.
Define the two different types of intermolecular forces and rank them by their strengths of attractions.

understand...
The basic trends in how many bonds elements form, along with how many unshared electron pairs they have.
Why some molecules are non-polar or polar.
How intermolecular forces can affect the properties of compounds.
That intermolecular forces are just forces of attraction and they are NOT bonds.

Ch 7 & 8 Homework

Due the day before the test. Must be completed neatly. Use full sentences and/or show all work in calculations for full credit where applicable. This assignment may be passed in anytime before the test though. Students may also elect to pass in questions in smaller chunks during the course of our coverage of the chapter if that is more conducive to their learning style.

Read the following pages in chapters 7 & 8: (p 191-199, p 215 – 233)

Do the following problems:

pg 195 Q 4, 7, 8 (Draw Lewis Structures for these problems)
pg 199 Q 3, 6
pg 212 Q 2, 3
pg 217 Q 1, 2
pg 226 Q 1, 3, 4
pg 229 Q 3, 4
pg 233 Q 3, 4 (ignore the smell part to these questions)
pg 239 Q 1, 3, 4 (a-c)

VSERP Model over →

Valence Shell Electron Pair Repulsion Model

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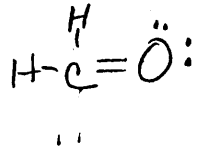
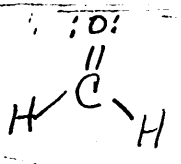
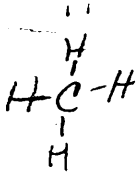
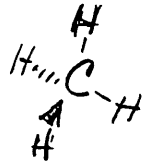
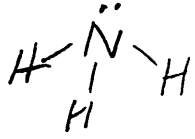
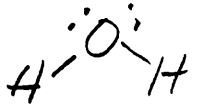
Geometry Type	Molecular Type	# of unshared e⁻ pairs on central atom	Example	Lewis Struct	3-D Struct
Linear	A_2	0	H_2, HCl	H–H; H–Cl:	
Linear	AB_2	0	HCN	H–C≡N:	
Trigonal Planar	AB_3	0	CH_2O		
Tetrahedral	AB_4	0	CH_4		
Trigonal Pyramidal	AB_3E	1	NH_3		
Bent	AB_2E_2	2	H_2O		

Polar Covalent Bonds have Dipoles

$\longrightarrow$ represents a dipole, points to where the e^- are going.

$\overset{+}{\longrightarrow}$
N O
3.0 3.5

$\overset{+}{\longrightarrow}$
O F always point to the more electroneg. atom.

$\overset{+}{\longrightarrow}$
H_2O show H O

Non Polar Covalent Bonds $\Rightarrow$ No Dipoles

example)

F_2

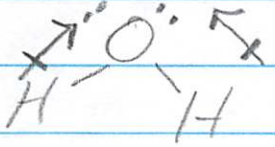
F – F 4.0 – 4.0 = 0.0 nonpolar

4.0 4.0 No dipole

symmetrical shape cancels Polarity

CO_2 $\overset{+}{\longrightarrow}$ $\overset{+}{\longrightarrow}$
:O=C=O:
2.5 3.5 3.5 – 2.5 = 1.0 bonds are polar
Linear, AB_2
Yet CO_2 is Non Polar

H_2O



Bent, AB_2E_2

polar bonds

water molecule is not symmetrical, so H_2O is Polar, all the e^- are on the side of the oxygen, O.

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Chapter HW due Wed 1/11
Test on Thurs 1/12

Electronegativity - how well an atom attracts electrons in a bond.

Across a period, electroneg. increases because adding more ⊕ charge, i.e. protons, which attract the ⊖ charge electrons more strongly, more electroneg going northeast on Periodic Table.
Down a Group, electroneg. decreases because electrons are further away from ⊕ nucleus as more energy levels are added down a Group

Metals have low levels of electroneg.
Non metals have high electroneg. levels

Differences in Electronegativity:
large differences ⇒ Ionic bonds
Medium difference ⇒ Polar Covalent
Small difference ⇒ Non Polar Covalent

Metals form (+) cations b/c lose e^-.
Metals have low electronegativity, i.e. low attraction for e^-

Determining if a molecule is Polar or Non Polar:
How to determine Bond Polarity:
Figure out if one atom attracts e^- more strongly, compare the electroneg. value difference.
Three bond types: depend on difference of electronegativity
Ionic - large diff. Nonmetal takes e^- from metal. 1.7 → (+)
Polar Covalent - medium diff
diff between 0.3 - 1.7
Nonpolar covalent - small diff.
no poles, have an even distribution of electrons, e^-. 0.0 - 0.3

Examples) Look at diff. in electroneg.

$\underset{0.9}{Na}\underset{3.5}{I}$ 3.5 - 0.9 = 1.6 ⇒ Polar Cov.

$\underset{1.0}{Ca}\underset{3.0}{Cl_2}$ 3.0 - 1.0 = 2.0 ⇒ Ionic

$\underset{3.0}{N_2}\underset{3.5}{O_5}$ 3.5 - 3.0 = .5 ⇒ Polar Cov.

$\underset{3.0}{NCl_3}$ $\underset{3.0}{}$ 3.0 - 3.0 = 0 ⇒ Non Polar Cov.

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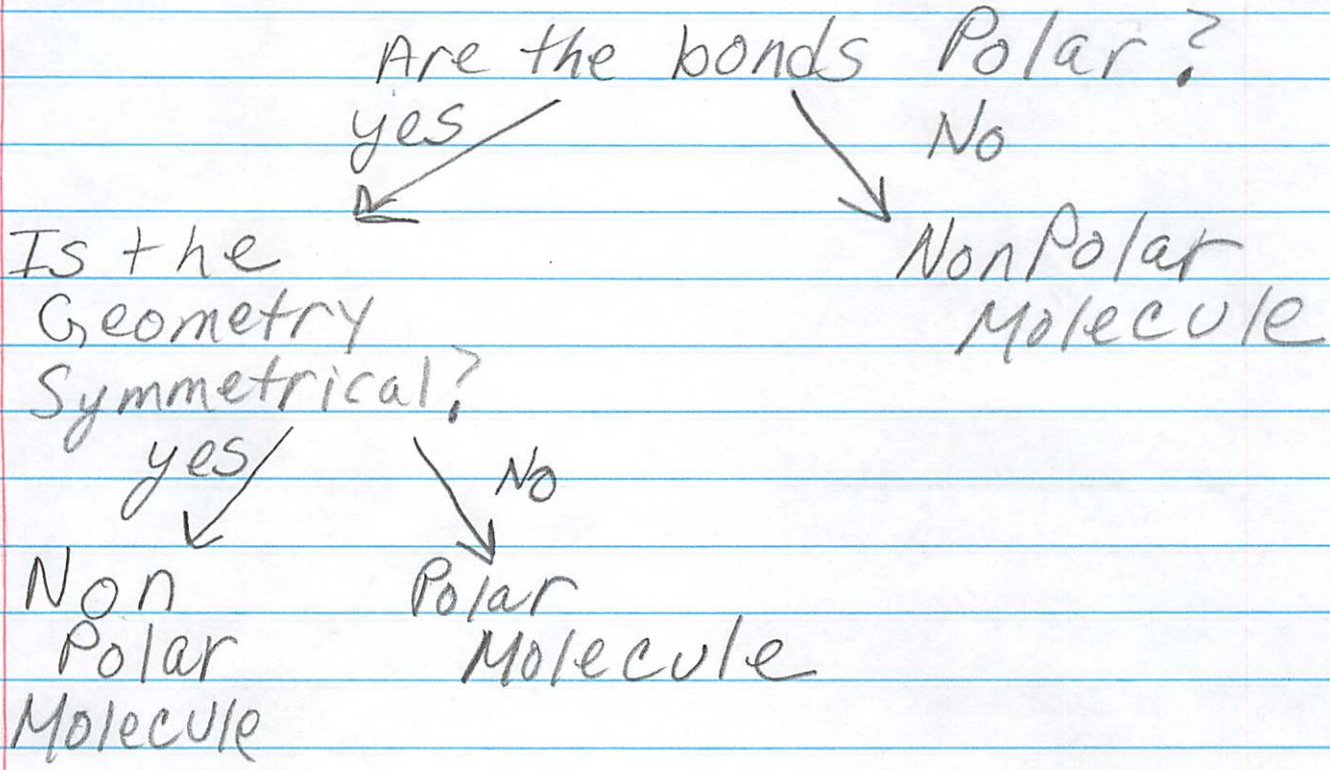
Polarity Flowchart



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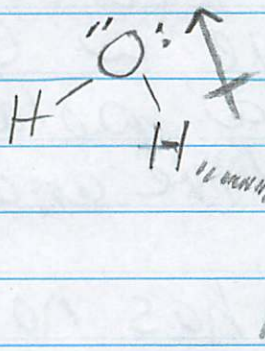
Intermolecular Forces - attractive forces between molecules. Are NOT bonds, just weak attractive forces.
water molecules have a charge because water is a polar molecule, i.e. has positive and negative end.
Hexane is nonpolar, has no charge.

1) Dipole-Dipole Interactions - Attractive forces between Polar molecules.
Dipole is an equal but opposite charge separated by short distance.

Properties affected by Intermolecular Forces:
- Melting Pt. (breaking molecules apart
- Boiling Pt. from each other)
- Solubility - oil (nonpolar) water (polar) do not mix due to No charges present to attract each other.

2) Hydrogen Bonding - attraction between a H bonded to a strong electroneg. element and an unshared pair of e^- on another electroneg. atom.



hydrogen bond - a strong intermolecular force. is not a bond, is a strong attractive force

Unique Properties of water (H_2O)

1) Cohesion
2) Water expands when it freezes, ice floats
3) takes a long time to evaporated
4) Waterhas surface tension
5) water flows against gravity going up a tree.
6) Hydrogen bonds form in DNA, Keep strands attached to each other.